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PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Goodson, et al.

Serial No: 10/053,859

Filed: 01/19/02

For: Electroosmotic Microchannel
Cooling System

RECEIVED

JAN 15 2003

TECHNOLOGY CENTER R3700

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Applicant hereby voluntarily discloses the items listed on the attached Form PTO-1449 to the Assistant Commissioner for Patents. Copies of items A – ALC (331 references) are enclosed herewith.

Applicant further reserves the right to establish the patentability of the claimed invention over any of the listed information should they be applied as references, and/or to prove that some of the cited information may not be prior art, and/or to prove that some of the cited information may not be enabling for the teachings they purport to offer. This statement further should not be construed as a representation that an exhaustive search has been made, or that the information cited herewith is material, or that there does not exist information more material to the examination of the present Application. The Examiner is specifically requested not to rely solely on the information submitted herein. On the contrary, the Examiner is requested to conduct an independent and thorough review of the information, and to form independent opinions as to their significance.

It is respectfully requested that the Examiner initial and retain copies of the enclosed PTO-1449 and to indicate in the official file wrapper of the above-identified patent application that each item of the cited information has been considered.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to account no. 09-0528.

Date: 11/7/03



John J. Timar

Attorney for Applicant
Reg#32,497

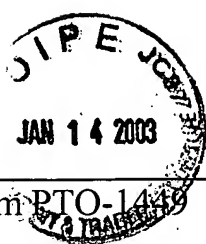
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Docket No.:S243 1020.1

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Form PTO-1449 INFORMATION DISCLOSURE CITATION <i>(Use several sheets if necessary)</i>	Attorney Docket No. S243 1020.1	Serial No. 10/053,859
	Applicant Goodson, et al.	
	Filing Date 01/19/02	Group 3743

U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	AA	5,869,894	02/97	Degani, et al.	257	723	
	AB	5,901,040	05/99	Cromwell, et al.	361	704	
	AC	6,025,208	02/00	Chui, et al.	438	50	
	AD	6,052,287	04/00	Palmer, et al.	361	767	
	AE	6,133,631	10/00	Belady	257	714	
	AF	6,137,693	10/00	Schwiebert, et al.	361	803	
	AG	6,191,945	02/01	Belady, et al.	361	704	
	AH	6,285,550	09/01	Belady	361	704	
	AI	6,297,551	10/01	Dudderar, et al.	257	723	

FOREIGN PATENT DOCUMENTS

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	AJ	97212126.9	07/98	China	B01D	61/42	X	

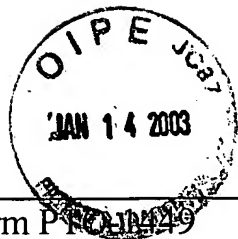
OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	AK	"Micro Channel Heat Exchanger for Cooling Electrical Equipment," Kawano, et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1998; v. 361 - 3, p. 173 - 180

* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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Patent and Trademark Office; U. S. DEPARTMENT OF COMMERCE



Form PTO-1029 INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Attorney Docket No. S243 1020.1	Serial No. 10/053,859
	Applicant Goodson, et al.	
	Filing Date 01/19/02	Group 3743

U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	BA	4,009,423	02/77	Wilson	361	385	
	BB	4,067,237	01/78	Arcella	73	204	
	BC	4,120,019	10/78	Arii, et al.	361	385	
	BD	4,151,548	04/79	Klein, et al.	357	82	
	BE	4,392,362	07/83	Little	62	514	
	BF	4,638,854	07/83	Noren	165	76	
	BG	4,675,783	06/87	Murase, et al.	361	385	
	BH	4,697,427	10/87	Niggemann, et al.	62	119	
	BI	4,829,432	05/89	Hershberger, et al.	361	424	

FOREIGN PATENT DOCUMENTS

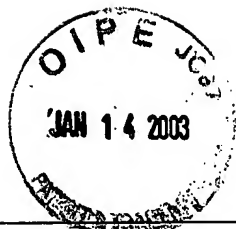
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	BJ	"Experimental Study on an Enhanced Microchannel Heat Sink for Microelectronics Applications," Keska, et al., American Society of Mechanical Engineers, EEP; 1999, v. 26 (2), p. 1235 - 1259
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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	CA	4,858,093	08/89	Sturgeon	363	20	
	CB	4,938,280	07/90	Clark	165	80.4	
	CC	4,951,740	08/90	Peterson, et al.	165	32	
	CD	4,975,825	12/90	Huss, et al.	363	141	
	CE	5,010,292	4/91	Lyle, Jr.	323	274	
	CF	5,131,859	07/92	Bowen, et al.	439	194	
	CG	5,144,531	09/92	Go, et al.	361	382	
	CH	5,162,974	11/92	Currie	361	385	
	CI	5,199,165	4/93	Crawford, et al.	29	846	

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	CJ	"High Performance Forced Air Cooling Scheme Employing Microchannel Heat Exchangers," Kleiner, et al., IEEE Transactions on Components, Packaging, and Manufacturing Tech., Part A, Dec 1995; v. 18, no. 4, p. 795- 804
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Sheet 4 of 38

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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	DA	5,229,915	07/93	Ishibashi, et al.	361	385	
	DB	5,311,397	05/94	Harshberger, et al.	361	683	
	DC	5,313,099	05/94	Tata, et al.	287	717	
	DD	5,339,214	08/94	Nelson	361	695	
	DE	5,365,749	11/94	Porter	62	259.2	
	DF	5,461,541	10/95	Wentland, Jr. et al.	361	707	
	DG	5,471,850	12/95	Cowans	62	223	
	DH	5,504,650	04/96	Katsui, et al.	361	697	
	DI	5,504,924	04/96	Ohashi, et al.	375	800	

FOREIGN PATENT DOCUMENTS

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							Yes	No

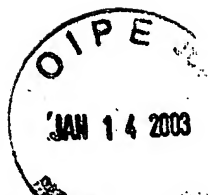
OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	DJ	"Optimal Thermal Design of Air Cooled Forced Convection Finned Heat Sinks, Experimental Verification," Knight, et al., Conference: Intersociety Conference on Thermal Phenomena in Electronic Sysems - I-Therm '92, 2/5 - 8/92, Austin, TX
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Form PTOL 449 INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Attorney Docket No. S243 1020.1	Serial No. 10/053,859
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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	EA	5,508,908	04/96	Kazama, et al.	363	141	
	EB	5,513,070	04/96	Xie, et al.	361	700	
	EC	5,544,412	08/96	Romero, et al.	29	832	
	ED	5,565,705	10/96	Romero, et al.	257	718	
	EE	5,579,827	12/96	Chung	165	80.3	
	EF	5,598,320	1/97	Toedtman, et al.	361	687	
	EG	5,608,262	3/97	Degani, et al.	257	723	
	EH	5,621,635	4/97	Takiar	363	141	
	EI	5,646,828	7/97	Degani, et al.	361	715	

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	EJ	"Heat Transfer of Microstructures for Integrated Circuits," Koh, et al. International Communications in Heat and Mass Transfer; Jan - Feb 1986; v. 13, no. 1, p. 89 - 98.
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Form PTO-449 INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Attorney Docket No. S243 1020.1	Serial No. 10/053,859
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	Filing Date 01/19/02	Group 3743

U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	FA	6,034,425	03/00	Chiang, et al.	257	697	
	FB	6,121,682	09/00	Kim	257	723	
	FC	6,127,726	10/00	Bright, et al.	257	691	
	FD	6,154,370	11/00	Degani, et al.	361	761	
	FE	6,201,302	03/01	Tzu	257	724	
	FF	6,204,562	03/01	Ho, et al.	257	777	
	FG	6,215,193	04/01	Tao, et al.	257	777	
	FH	6,268,660	07/01	Dhong, et al	257	774	
	FI	6,278,190	08/01	Tomita	257	777	

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

FJ	*Convection Cooling of Microelectronic Chips," Konecni, et al., Conference: Intersociety Conference on Thermal Phenomena in Electronic Systems - I-Therm '92, 2/5 - 8/92, Austin, Texas
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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	GA	6,335,566	01/02	Hirashima, et al.	257	686	
	GB	6,344,682	02/02	Tomita	257	686	
	GC	5,965,813	10/99	Wan, et al.	73	204.26	
	GD	5,965,001	10/99	Chow, et al.	204	600	
	GE	5,978,220	11/99	Frey, et al.	361	699	
	GF	5,997,713	12/99	Beetz, Jr., et al.	205	124	
	GG	5,998,240	12/99	Hamilton, et al.	438	122	
	GH	6,007,309	12/99	Hartley	417	322	
	GI	6,010,316	01/00	Haller, et al.	417	322	

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	GJ	"Modeling of Two-Phase Microchannel Heat Sinks for VLSI Chips," Koo, et al., Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS); 2001; p. 422 - 426
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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	HA	5,801,442	09/98	Hamilton, et al.	257	714	
	HB	5,835,345	11/98	Staskus, et al.	361	699	
	HC	5,836,750	11/98	Cabuz	417	322	
	HD	5,858,188	01/99	Soane, et al.	204	454	
	HE	5,863,708	01/99	Zanzucchi, et al.	430	320	
	HF	5,870,823	02/99	Bezama, et al.	29	848	
	HG	5,880,524	03/99	Xie	257	704	
	HH	5,901,037	05/99	Hamilton, et al.	361	699	
	HI	5,940,270	08/99	Pucket	361	699	

FOREIGN PATENT DOCUMENTS

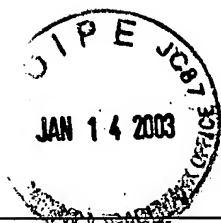
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							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	HJ	"Simulation of Micro-Channel Heat Sinks for Optoelectronic Microsystems," Kreutz, et al., Microelectronics Journal; October 2000; v. 31, no. 9, p. 787 - 790
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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
	IA	6,013,164	01/00	Paul, et al.	204	450	
	IB	6,019,882	02/00	Paul, et al.	204	450	
	IC	6,054,034	04/00	Soane, et al.	204	601	
	ID	6,096,656	08/00	Matzke, et al.	438	702	
	IE	6,101,715	08/00	Fuesser, et al.	29	890.03	
	IF	6,129,145	10/00	Yamamoto, et al.	165	168	
	IG	6,146,103	11/00	Lee, et al.	417	50	
	IH	6,154,363	11/00	Chang	361	699	
	II	6,174,675	01/01	Chow, et al.	435	6	

FOREIGN PATENT DOCUMENTS

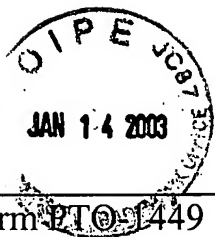
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OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

IJ	"Fabrication of Very Smooth Walls and Bottoms of Silicon Microchannels for Heat Dissipation of Semiconductor Devices," Dwivedi, et al., Microelectronics Journal; 2000; v. 31, no. 6, p. 405 – 410.
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U.S. PATENT DOCUMENTS

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	JA	6,210,986	01/01	Arnold, et al.	438	42	
	JB	6,216,343	04/01	Leland, et al.	29	890.032	
	JC	6,227,809	05/01	Forster, et al.	417	53	
	JD	6,234,240	05/01	Cheon	165	80.3	
	JE	6,238,538	05/01	Parce, et al.	204	600	
	JF	2001/0016985	08/21	Insley, et al.	29	890.039	
	JG	6,287,440	09/01	Arnold, et al.	204	450	
	JH	2001/0024820	09/01	Mastromatteo, et al.	435	287.2	
	JI	6,301,109	10/01	Chu, et al.	361	690	

FOREIGN PATENT DOCUMENTS

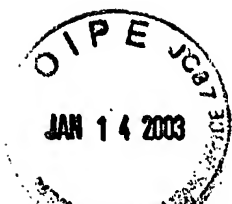
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

JJ	"Silicon Micromachining and Micromachines," Esashi, Wear; September 1, 1993; v. 168
	No. 1 - 2, p. 181 - 187

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	KA	6,313,992	11/01	Hildebrandt	361	700	
	KB	2001/0044155	11/01	Paul, et al.	436	161	
	KC	6,321,791	11/01	Chow	137	833	
	KD	6,322,753	11/01	Lindberg, et al.	422	192	
	KE	6,324,058	11/01	Hsiao	361	699	
	KF	2001/0046703	11/01	Burns, et al.	435	303.1	
	KG	3,923,426	12/75	Theeuwes	417	48	
	KH	4,312,012	01/82	Frieser, et al.	357	82	
	KI	4,450,472	05/84	Tuckerman, et al.	357	82	

FOREIGN PATENT DOCUMENTS

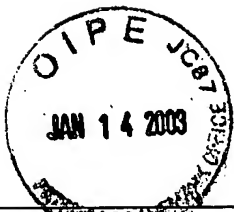
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	KJ	"Silicon Micromachining for Integrated Microsystems," Esashi, Vacuum; Jun - Aug 1996, v. 47, no. 6 - 8 pp. 469 - 474
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	LA	4,516,632	05/85	Swift, et al.	165	167	
	LB	4,516,632	12/85	Eastman, et al.	361	385	
	LC	4,567,505	01/86	Pease, et al.	357	81	
	LD	4,573,067	02/86	Tuckerman, et al.	357	82	
	LE	4,758,926	07/88	Herrell, et al.	361	385	
	LF	4,868,712	09/99	Woodman	361	388	
	LG	4,894,709	01/90	Phillips, et al.	357	82	
	LH	4,908,112	03/90	Pace	204	299	

FOREIGN PATENT DOCUMENTS

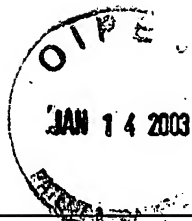
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	LJ	"Experimental evaluation of micro heat exchangers fabricated in silicon", Kuan, American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1996; v.331, p.131-136
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	MA	5,016,138	05/91	Woodman	361	381	
	MB	5,057,908	10/91	Weber	357	81	
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	MD	5,083,194	01/92	Bartilson	357	81	
	ME	5,096,388	03/92	Weinberg	417	322	
	MF	5,099,311	03/92	Bonde, et al.	357	82	
	MG	5,125,451	06/92	Matthews	165	80.4	
	MH	5,099,910	03/92	Walpole, et al.	165	80.4	
	MI	5,131,233	07/92	Cray, et al.	62	64	

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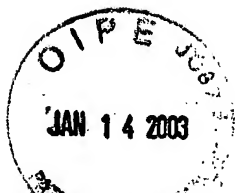
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OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	MJ	"Flow characteristics of water through a microchannel between two parallel plates with electrokinetic effects", Mala et al., International Journal of Heat and Fluid Flow; Oct 1997; v.18, no.5, p.489-496
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	NA	5,203,401	04/93	Hamburgen, et al.	165	80.4	
	NB	5,218,515	06/93	Bernhardt	361	385	
	NC	5,219,278	06/93	Van Lintel	417	413	
	ND	5,230,564	07/93	Bartilson, et al.	374	178	
	NE	5,232,047	08/93	Matthews	165	168	
	NF	5,239,200	08/93	Messina, et al.	257	714	
	NG	5,263,251	11/93	Matthews	29	840.036	
	NH	5,274,920	01/94	Matthews	29	890.039	
	NI	5,281,026	01/94	Bartilson, et al.	374	143	

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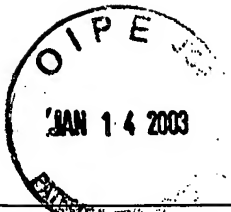
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OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	NJ	"Heat transfer and fluid flow in microchannels", Mala et al., International Journal of Heat and Mass Transfer; Sep 1997; v.40, no.13, p.3079-3088
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	OA	5,309,319	05/94	Messina	361	699	
	OB	5,317,805	06/94	Hoopman, et al.	29	890.03	
	OC	5,325,265	06/94	Turlik, et al.	361	702	
	OD	5,336,062	08/94	Richter	417	413	
	OE	5,383,340	01/95	Larson, et al.	62	259.2	
	OF	5,427,174	06/95	Lomolino, Sr., et al.	165	1	
	OG	5,436,793	07/95	Sanwo, et al.	361	689	
	OH	5,459,099	10/95	Hsu	437	180	
	OI	5,508,234	04/96	Dusablon, Sr., et al.	437	228	

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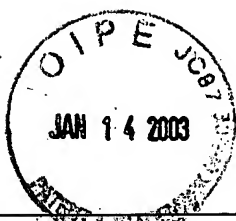
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	OJ	"Enhancement of Multichip Modules ("MCMs) cooling by incorporating microheatpipes and other high thermal conductivity materials into microchannel heat sinks", Marongiu et al., Proceedings -Electronic Components and Technology Conference; 1998; p.45-50
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	PA	5,514,832	05/96	Dusablon, Sr., et al.	174	15.1	
	PB	5,514,906	05/96	Love, et al.	257	712	
	PC	5,575,929	11/96	Yu, et al.	216	10	
	PD	5,641,400	06/97	Kaltenbach, et al.	210	198.2	
	PE	5,692,558	12/97	Hamilton, et al.	165	80.4	
	PF	5,696,405	12/97	Weld	257	714	
	PG	5,703,536	01/98	Davis, et al.	330	289	
	PH	5,704,416	01/98	Larson, et al.	165	104.33	
	PI	5,727,618	03/98	Mundinger, et al.	165	80.4	

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	PJ	*Integrated electroosmotic pumps and flow manifolds for total chemical analysis systems", Manz et al., Conference: 1991 International Conference on Solid-State Sensors and Actuators, 1991 Jun 24-28, San Francisco, CA, USA
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	QA	5,759,014	06/98	Van Lintel	417	413.3	
	QB	5,763,951	06/98	Hamilton, et al.	257	714	
	QC	5,774,779	06/98	Tuchinskiy	419	2	
	QD	2001/0055714	12/01	Cettour-Rose, et al.	429	122	
	QE	6,337,794	01/02	Agonafer, et al.	361	690	
	QF	5,942,093	08/99	Rakestraw, et al.	204	450	
	QG	6,351,384	02/02	Daikoku, et al.	361	704	
	QH	6,186,660	02/01	Kopf-Still, et al.	366	340	

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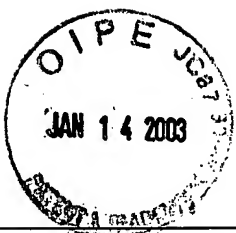
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	QI	"Electroosmotically induced hydraulic pumping with integrated electrodes on microfluidic devices", McKnight et al., Analytical Chemistry; Aug 15, 2001; v.73, no.16, p.4045-4049
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	RA	6,068,752	05/00	Dubrow, et al.	204	604	
	RB	6,090,251	07/00	Sundberg, et al.	204	453	
	RC	6,100,541	08/00	Nagle, et al.	250	573	
	RD	6171,067	01/01	Parce	417	48	
	RE	6,176,962	01/01	Soane, et al.	156	292	
	RF	6,210,986	04/01	Arnold, et al.	438	42	
	RG	6,221,226	04/01	Kopf-Sill	204	602	
	RH	6,277,257	08/01	Paul, et al.	204	450	
	RI	5,216,580	09/93	Davidson, et al.	361	385	
	RJ	5,560,423	10/96	Larson, et al.	165	104.26	

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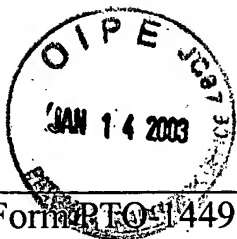
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	RK	"Microchannel heat sinks for two-dimensional high-power-density diode laser arrays", Missaggia et al., IEEE Journal of Quantum Electronics; Sep 1989; v.25, no.9, p.1988-1992
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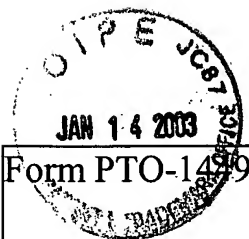
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

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	SA	"Partial electroosmotic pumping in complex capillary systems. Part 1: Principles and general theoretical approach", Morf et al., Sensors and Actuators, B: Chemical; Feb 2001; v.72, no.3, p.266-272
	SB	"High average power 2-D laser diode arrays on silicon microchannel collers", Mundinger et al., Conference: Conference on Lasers and Electro-Optics, 1989 Apr 24-28, Baltimore, MD, USA
	SC	"Parametric optimization of multichanneled heat sinks for VLSI chip cooling", Murakami et al., IEEE Transactions on Components and Packaging Technologies; March 2001; v.24, no.1, p.2-9
	SD	"Experimental investigation of heat transfer in flat plates with rectangular microchannets", Peng et al., International Journal of Heat and Mass Transfer; Jan 1995; v.38, no.1, p.127-137
	SE	"Forced convection and flow boiling heat transfer for liquid flowing through microchannels", Peng et al., International Journal of Heat and Mass Transfer; Sep 1993; v.36, no.14, p.3421-3427
	SF	"Enhancing the critical heat flux using microchanneled surfaces", Peng et al., Journal of Enhanced Heat Transfer; 1998; v.5, no.3, p.165-176
	SG	"Cooling characteristics with microchannled structures", Peng et al., Journal of Enhanced Heat Transfer; 1994; v.1, no.4, p.315-326
	SH	"Convective heat transfer and flow friction for water flow in microchannel structures", Peng et al., International Journal of Heat and Mass Transfer; Aug 1996; v.39, no.12, p.2599-2608

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							Yes	No

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	TA	"Heat transfer characteristics of water flowing through microchannels", Peng et al., Experimental Heat Transfer; Oct-Dec 1994; v.7, no. 4, p.265-283						
	TB	"Microchannel integrated heat sinks in silicon technology", Perret et al., Conference Record - IAS Annual Meeting (IEEE Industry Applications Society); 1998; v.2, p.1051-1055						
	TC	"Performance of a MEMS based micro capillary pumped loop for chip-level temperature control", Pettigrew et al., Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS); 2001; p.427-430						
	TD	"Liquid transport in micron and submicron channels", Pfahler et al., Sensors and Actuators, A: Physical; 3 Pt3 1990; v.22, no. 1-3, p.431-434						
	TE	"Experimental measurements of fluid flow and heat transfer in microchannel cooling passages in a chip substrate", Rahman et al., American Society of Mechanical Engineers, EEP; 1993; v.4-2, p.685-692						
	TF	"Flow rate measurement via conductivity monitoring in micro-fluidic devices", Rainey et al., Proceedings of SPIE - The International Society for Optical Engineering; 2000; v. 4177, p. 185-193						
	TG	"Fabrication techniques to realize CMOS-compatible microfluidic microchannels", Rasmussen et al., Journal of Microelectromechanical Systems; June 2001; v. 10, no. 2, p.286-297						
	TH	"Impact of channel geometry on two-phase flow heat transfer characteristics of refrigerants in microchannel heat exchangers", Ravigururajan, Journal of Heat Transfer, Transactions ASME; May 1998; v.120, no.2, p.485-491						

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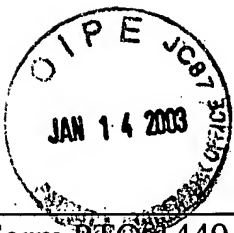
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	UA	"Liquid flow characteristics in a diamond-pattern micro-heat-exchanger", Ravigururajan et al., American Society of Mechanical Engineers, Dynamic Systems and Control Division (Publication) DSC; 1996; v.59, p.159-166
	UB	"Single-phase flow thermal performance characteristics of a parallel micro-channel heat exchanger", Ravigururajan et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1996; v.329, no. 7, p.157-166
	UC	"Effect of heat flux on two-phase flow characteristics of refrigerant flows in a micro-channel heat exchanger", Ravigururajan et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1996; v.329, no. 7, p.167-178
	UD	"Acousto-and electroosmotic microfluidic controllers", Rife et al., Proceedings of SPIE – The International Society for Optical Engineering; 1998; v.3515, p.125-135
	UE	"Liquid flow and heat transfer in microchannels: A review", Rostami et al., Heat and Technology; 2000; v.18, no. 2, p.59-68"
	UF	"Very high heat flux microchannel heat exchanger for cooling of semiconductor laser diode arrays", Roy et al., IEEE Transactions on Components, Packaging, and Manufacturing Technology Part B: Advanced Packaging; May 1996; v.19, no.2, p.444 - 451
	UG	"Convective heat transfer in microchannels", Samalam, Journal of Electronic Materials, Vol. 18, pp. 611-617, 1989

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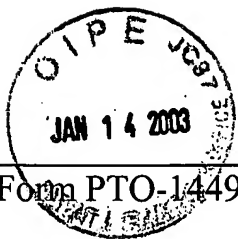
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	VA	"Optimal structure for microgrooved cooling fin for high-power LSI devices", Sasaki, S.; Kishimoto, Electronics Letters; Dec 4, 1986; v.22, no. 25, p.1332-1334						
	VB	"Electroosmotic pumping and valveless control of fluid flow within a manifold of capillaries on a glass chip", Seiler, et al., Analytical Chemistry; October 15, 1994; v.66, no. 20, p.3485-3491						
	VC	"Micro heat spreader enhanced heat transfer in MCMs", Shen et al., Proceedings of the IEEE Multi-Chip Module Conference; January 31, 1995; p.189-194						
	VD	"Microflow devices and systems", Shoji et al., Journal of Micromechanics and Microengineering; Dec 1994; v.4, no.4, p.157-171						
	VE	"Overview of fabrication methods and fluid flow and heat transfer characteristics of micro channels", Sunden et al., Conference: Second Baltic Heat Transfer Conference, 1995 Aug 21-23, Jurmala, Latvia						
	VF	"Electrokinetic dewatering and thickening. I. Introduction and historical review of electrokinetic applications", Sunderland, J Appl Electrochem; Sep 1987; v.17, no.5, p.889-898						
	VG	"High-performance heat sinking for VLSI", Tuckerman et al., IEEE Electron Device Lett; May 1981; v.EDL-2, no. 5, p.126-129						

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	WA	"Analysis of two-layered micro-channel heat sink concept in electronic cooling", Vafal et al., International Journal of Heat and Mass Transfer; Jun 1999; v.42, no. 12, p.2287-2297						
	WB	"Two-phase flow in microchannels", Stanley, et al., Microelectromechanical Systems (MEMS), DSC-Vol. 62/HTD-Vol.254, p.143-152						
	WC	"Experimental investigation on liquid forced-convection heat transfer through microchannels", Wang et al., International Journal of Heat and Mass Transfer; Mar 1994; v.37, no. SUPPL 1, p.73-82						
	WD	"Analysis of microchannels for integrated cooling", Weisberg et al., International Journal of Heat and Mass Transfer; Oct 1992; v.35, no. 10, p. 2465-2474						
	WE	"Micro fluidic system of micro channels with on-site sensors by silicon bulk micromachining", Yang et al., Proceedings of SPIE - The International Society for Optical Engineering; 1999; v. 3877, p.267-272						
	WF	"Modeling forced liquid convection in rectangular microchannels with electrokinetic effects", Yang et al., International Journal of Heat and Mass Transfer; Dec 1998; v.41, no. 24, p.4229-4249						
	WG	"Uniform channel micro heat exchangers", Yin et al, Journal of Electronic Packaging, Transactions of the ASME; Jun 1997; v.119, no.2, p.89-93						
	WH	"Fabrication, Derivatization and Applications of Plastic Microfluidic Devices", Barker, et al., Proceedings of SPIE - The International Society for Optical Engineering, Nov. 2000, v.4205, p.112-118						

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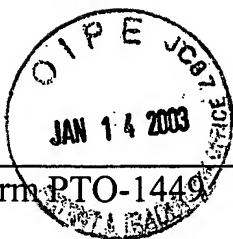
	XA	"Experimental and theoretical investigation of fluid flow and heat transfer in microtubes", Yu et al., ASME/JSME Thermal Engineering Joint Conference - Proceedings; 1995; v.1, p.523-530						
	XB	"Fabrication and characterization of electrokinetic micro pumps", Zeng et al., Thermomechanical Phenomena in Electronic Systems -Proceedings of the Intersociety Conference; 2000; v.2, p.31-36						
	XC	"Experimental study on local heat transfer with liquid impingement flow in two-dimensional microchannels", Zhuang et al., International Journal of Heat and Mass Transfer, Oct 1997, v.40, no. 17, p.4055-4059						
	XD	"Heat out of small packages", Joshi, Mechanical Engineering, Dec. 2001, p.56-58						
	XE	"Heat Exchange Element for Semiconductor Device Cooling", Edmonds, et at., IBM Technical Disclosure Bulletin, Aug 1980, v.23, no.3, p.1057						
	XF	"Liquid Cooling of Integrated Circuit Chips", Anacker, IBM Technical Disclosure Bulletin, Feb 1978, v.20, no.9, p.3742-3743						
	XG	"Heat transfer from silicon chips and wafers", Noth, IBM Technical Disclosure Bulletin, May 1975, v.17, no.12, p.3544						
	XH	"Forced boiling cooling system with jet enhancement for critical heat flux extension", IBM Technical Disclosure Bulletin, Oct 1996, v.39, no. 10, p.143						

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	YA	"Miniature heat exchanger for corrosive media", IBM Technical Disclosure Bulletin, Jan 1995, v.38, no.01, p.55-56
	YB	"Self-contained active heat dissipation device", IBM Technical Disclosure Bulletin, Apr 1996, v.39, no.04, p.115-116
	YC	"Liquid jet cooling of integrated circuit chips", Sachar, IBM Technical Disclosure Bulletin, Feb 1978, v.20, no.9, p.3727-3728
	YD	"Centerless ceramic package with directly connected heat sink", Ronkese, IBM Technical Disclosure Bulletin, Feb 1978, v.20, no.9, p.3577-3578
	YE	"Jet cooling cup for cooling semiconductor devices", Keller, et al., IBM Technical Disclosure Bulletin, Feb 1978, v.20, no.9, p.3575-3576
	YF	"Device cooling", Johnson, IBM Technical Disclosure Bulletin, Mar 1978, v.20, no.10, p.3919-3920
	YG	"Integrated circuit module package cooling structure", Pascuzzo, et al., IBM Technical Disclosure Bulletin, Mar 1978, v.20, no.10, p.3898-3899
	YH	"Integrated module heat exchanger", Antonetti, et al., IBM Technical Disclosure Bulletin, Apr 1978, v.20, no. 11A, p.4498

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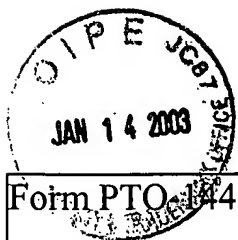
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	ZC	"Liquid cooling of a multichip module package", Balderes, et al., IBM Technical Disclosure Bulletin, Apr 1978, v.20, no.11A, p.4336-4337						
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	ZG	"Multi-chip package with cooling by a spreader plate in contact with a chip having cylindrical holes mating with an inverse frame providing water flow within its pins", IBM Technical Disclosure Bulletin, Oct 1988, v.31, no.5, p.141-142						
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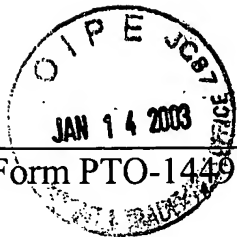
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AAB	"Convection cooling apparatus", Damm, IBM Technical Disclosure Bulletin, Dec 1977, v.20, no.7, p.2755-2756
AAC	"TCM-like circuit module with local heat sink resting on chip and chip separated from coolant by bellows with pins and deflector plate attached to local heat sink and extending above bellows into region of coolant flow", IBM Technical Disclosure Bulletin, Apr 1989, v.31, no.11, p.305-306
AAD	"Circuit module cooling with multiple pistons contacting a heat spreader/electrical buffer plate in contact with chip", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p.5-7
AAE	"Circuit package with circulating boiling liquid and local heat exchanger to limit vapor in coolant outlet", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p. ³⁴
AAF	"Water-cooled circuit module with grooves forming water passages near heat-producing devices", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p.49-50
AAG	"Cold plate for thermal conduction module with only peripheral mounting bolts, large surface area fin inserts and reduced water flow and thermal resistances", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p.59
AAH	"Thermal control hardware for accelerated run-in testing of multi-chip modules", IBM Technical Disclosure Bulletin, Oct 1989, v.32, no.5A, p.129-130

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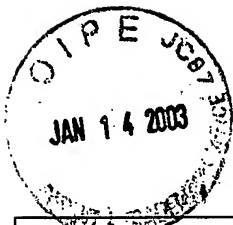
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	ABD	"Semiconductor chip cooling package", Doo, et al., IBM Technical Disclosure Bulletin, Sep 1977, v.20, no.4, p.1440-1441						
	ABE	"Pin fin array heat pipe apparatus", IBM Technical Disclosure Bulletin, Sep 1994, v.37, no.09, p.171						
	ABF	"Heat sink fabrication method", IBM Technical Disclosure Bulletin, Mar 1985, v.27, no.10A, p.5656-5657						
	ABG	"Thermal conduction module with liquid dielectric and pistons with surface treatment for enhanced nucleate boiling", IBM Technical Disclosure Bulletin, May 1985, v.27, no.12, p.6904						
	ABH	"Etched silicon integrated circuit heat sink", Brady, et al., IBM Technical Disclosure Bulletin, June 1984, v.27, no.1B, p.627						

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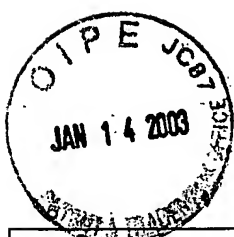
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ACB	"Heat-pipe vapor cooling etched silicon structure", Eldridge, et al., IBM Technical Disclosure Bulletin, Jan 1983, v.25, no.8, p.4118-4119
ACC	"Silicon heat sink for semiconductor ship", Chu, et al., IBM Technical Disclosure Bulletin, Apr 1982, v.24, no.11A, p.5743
ACD	"Data processor cooling with connection to maintain flow through standby pump", Goodman, IBM Technical Disclosure Bulletin, Dec 1983, v.26, no.7A, p.3325
ACE	"Cooling system for data processor with flow restricter in secondary loop to limit bypass-cooling water flow", Gallagher, et al., IBM Technical Disclosure Bulletin, Oct 1983, v.26, no.5, p.2658
ACF	"Cold plate for thermal conduction module with improved flow pattern and flexible base", Hwang, et al., IBM Technical Disclosure Bulletin, Feb 1983, v.25, no.9, p.4517
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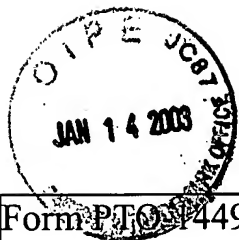
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	ADB	"Liquid-filled bellows heat sink", Kleinfelder, et al., IBM Technical Disclosure Bulletin, Mar 1979, v.21, no. 10, p.4125-4126
	ADC	"Cooling device for controlled rectifier", Bailey et al., IBM Technical Disclosure Bulletin, Apr 1979, v.21, no. 11, p.4609-4610
	ADD	"Silicon heat sink method to control integrated circuit chip operating temperatures", Ahearn, et al., IBM Technical Disclosure Bulletin, Jan 1979, v.21, no. 8, p.3378-3380
	ADE	"Chip cooling device", IBM Technical Disclosure Bulletin, Feb 1988, v.30, no. 9, p. 435-436
	ADF	"Cooling system for chip carrier on card", IBM Technical Disclosure Bulletin, Sep 1988, v.31, no. 4, p.39-40
	ADG	"Piping system with valves controlled by processor for heating circuit modules in a selected temperature profile for sealing integrity test under temperature stress", IBM Technical Disclosure Bulletin, Oct 1987, v.30, no. 5, p.336
	ADH	"Circuit module cooling with coaxial bellows providing inlet, outlet and redundant connections to water-cooled element", IBM Technical Disclosure Bulletin, Oct 1987, v.30, no. 5, p.345-347

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AEB	"Heat exchanger modules for data processor with valves operated by pressure from cooling water pump", IBM Technical Disclosure Bulletin, Oct 1987, v. 30, no. 5, p.419
AEC	"Enhanced cooling of thermal conduction module", IBM Technical Disclosure Bulletin, Oct 1987, v.30, no. 5, p.426
AED	"Integrally grooved semiconductor chip and heat sink", IBM Technical Disclosure Bulletin, Oct 1971, v.14, no. 5, p.1425
AEE	"Structure for cooling by nucleate boiling", Riseman, IBM Technical Disclosure Bulletin, Apr 1976, v.18, no. 11, p.3700
AEF	"Process for nucleate boiling enhancement", Chu, et al., IBM Technical Disclosure Bulletin, Dec 1975, v.18, no. 7, p.2227
AEG	"Electroerosion micropump", IBM Technical Disclosure Bulletin, May 1990, v.32, no. 12, p.342-343
AEH	"Thin heat pipe for cooling components on printed circuit boards", IBM Technical Disclosure Bulletin, Dec 1991, v.34, no. 7B, p.321-322

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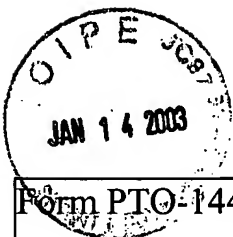
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	AFC	"An idea for maintaining a stable thermal environment for electronic devices", Slupe, et al., Research Disclosure, Aug 2001, p.13 12						
	AFD	"Autonomous displacement of a solution in a microchannel by another solution", Research Disclosure, June 2001, p.1046						
	AFE	"Thermal ink jet print head carriage with integral liquid cooling capabilities", Barner, et al., Xerox Disclosure Journal, Feb 1996, v.21, no.1, p.33-34						
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	AFG	"Heat generation and transport in sub-micron semiconductor devices", Fushinobu et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1993; v.253, p.21-28						
	AFH	"Integrated micro heat sink for power multichip module", Gillot et al., IEEE Transactions on Industry Applications; Jan-Feb 2000; v.36, no.1, p.217-221						

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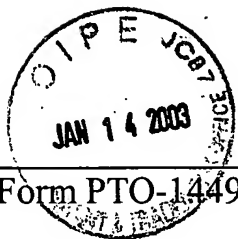
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	AGC	"Partial electroosmotic pumping in complex capillary systems. Part 2: Fabrication and application of a micro total analysis system suited for continuous volumetric nanotitrations", Guenat et al., Sensors and Actuators, B: Chemical; Feb 2001; v.72, no. 3, p.273-282						
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	AGG	"Nonuniform temperature distribution in electronic devices cooled by flow in parallel microchannels", Hetsroni et al., IEEE Transactions on Components and Packaging Technologies; March 2001; v.24, no.1, p.16-23						
	AGH	"Fused quartz substrates for microchip electrophoresis", Jacobson et al., Analytical Chemistry; July 1, 1995; v.67, no.13, p.2059-2063						

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	AHB	"Fabrication and characterization of a microsystem for a micro-scale heat transfer study", Jiang et al., Journal of Micromechanics and Microengineering; Dec 1999; v.9, no.4, p.422-428						
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	AHD	"Heat-transfer microstructures for integrated circuits", Tuckerman, Dissertation submitted to Dept. of Electrical Engineering, Stanford University, Feb. 1984						
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	AIG	"High flux boiling in low flow rate, low pressure drop mini-channel and micro-channel heat sinks", Bowers et al., International Journal of Heat and Mass Transfer; Jan 1994; v.37, no.2, p.321-332
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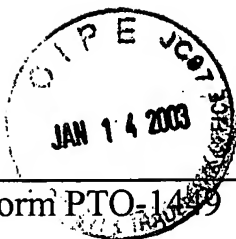
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	AKE	"Measurements of Heat Transfer in Microchannel Heat Sinks", Rahman, International Communications in Heat and Mass Transfer, May 2000, v.27, no.4, p.495-506
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	AKG	"Closed-Loop Electroosmotic Microchannel Cooling System for VLSI Circuits", Jiang, et at., printed in Journal of MEMS, Jan. 2002
	AKH	"Liquid Flows in Microchannels", Sharp, et al., CRC Press, 2002, Chapter 6, p.6-1 to 6-38

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U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate

FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	ALA	"Fabrication and characterization of electrokinetic micro pumps", Zeng, et al., 2000 Inter Society Conference on Thermal Phenomena, May 2000, p.31 -35
	ALB	"Thermal-hydraulic characteristic of micro heat exchangers", Wang, et al., American Society of Mechanical Engineers, Dynamic Systems and Control Division, DSC, 1991 ,v.32, p.331-339
	ALC	"Electrokinetic Generation of High Pressures Using Porous Microstructures", Paul, et at., Micro-total analysis systems, 1998, Banff, Canada 1998, p.49-52

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